Optimization of Human Microbial Ecology

Completed Technology Project (2012 - 2013)

Project Introduction

With the new tools of high-throughput sequencing providing unprecedented information about the diversity of microbes living in and on the human organism (microbiomics), a revolution is underway in our understanding of the role microbes are playing in human health. A review of literature about the microbiome of people or other mammals is necessary to determine if the efficiency of astronaut food assimilation can be improved metabolically or microbiologically to limit the amount of food required for long-duration space exploration.

Detailed information about the microbial ecology of individual human beings will soon be readily available and potentially of value in monitoring and manipulating not only their nutrition, but also their overall wellbeing. The challenge is processing and interpreting the massive amounts of sequence information and translating sequence information into relevant metabolic information. In the near future, efforts will shift from developing lexicons of microbial diversity on the whole body and focus on identifying either critical indicator species or on the metabolic potential of microbial assemblages in specific body locations (ear, nose, throat, gut, eyes, etc.) Depending on the information required, the focus will shift from determining the microbiome to monitoring change in the microbiome in different body habitats at difference space and time scales in the context of health, disease, rest, stress, and during the aging process. It will be important to determine the hierarchy and stability of microbes in and on the different habitats of the body.

In the closed environment of a space capsule, the microbiome of the astronauts and the capsule itself may provide detailed information about the specific requriements of each astronaut to maintain their health. Astronaut microbiomes may also be used to establish highly effficient personalized food assimilation programs.

Current breakthroughs in mcrobiome research, particularly in comparing obses and thin animals, indicate that there is a significant difference in microbially-mediated digestion efficiency. The preliminary literature research indicates that the system is complex and may or may not work as proposed. Ideally, more research, including experimental research, will be supported by NASA.

Anticipated Benefits

Future crewed long-duration missions could benefit from improved crew health and nutritional assimilation, along with reduced cargo and waste.

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Table of Contents

Project Introduction	1
Anticipated Benefits	1
Organizational Responsibility	1
Primary U.S. Work Locations and Key Partners	2
Stories	2
Project Management	2
Technology Areas	2

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Ames Research Center (ARC)

Responsible Program:

Center Innovation Fund: ARC CIF

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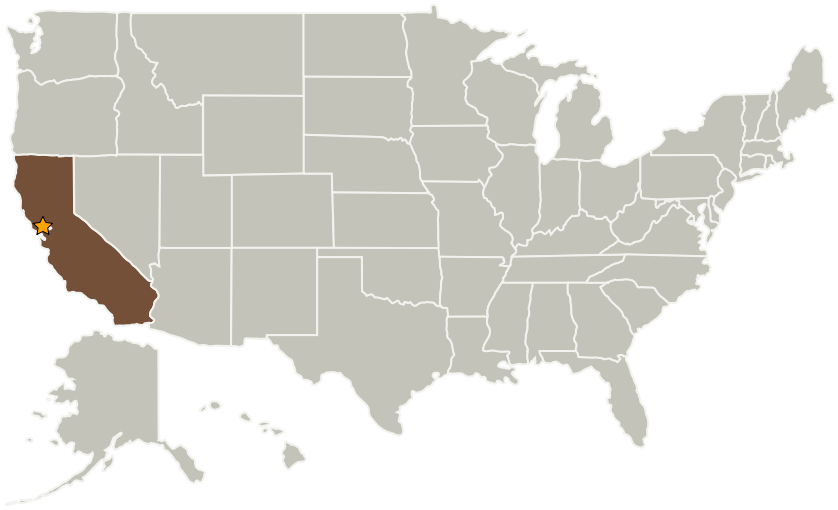
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations
California

Stories

1676 Approval #17536
(https://techport.nasa.gov/file/8764)

Project Management

Program Director:
Michael R Lapointe

Program Manager:
Harry Partridge

Principal Investigator:
Jonathan Trent

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.4 Environmental Monitoring, Safety, and Emergency Response
    - TX06.4.4 Remediation